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Mothers' Responses to Infant Gesture at 17 Months

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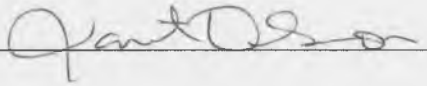
Faculty Approval Signature 

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HONORS THESIS ABSTRACT

Mothers' responses to infants' gestures are proposed as a mechanism for vocabulary acquisition. It is known that at 13 months mothers give more object labels to pointing than object extensions at a time when infants are learning object labels. However, it is not known how mothers respond to infants' gestures at 17 months when their vocabularies are expanding to include a greater variety of word types. Therefore, the current study examined mothers' responses to three types of infant gestures: points, open-hand reaches, and object extensions at 17 months to describe maternal provision of object labels, action labels, internal state labels and nonlabels. Mother-infant interactions were observed in three communicative contexts designed to elicit proto-declarative, ambiguous, and proto-imperative communicative bids. It was found that infant pointing dominated in the proto-declarative context and object extensions were most prevalent in the proto-imperative context. More points than reaches were seen in the ambiguous context. Mothers provided mostly object labels after points and action labels after object extensions. Internal state labels occurred at similar rates across gesture types. Findings could begin to explain why infants' gestures are related to their vocabulary sizes. Infant gestures elicit verbal responses from mothers that mirror infants' communicative intents.

Introduction

Children produce gestures before they begin generating words. Infant gesturing typically begins between 9 and 12 months generally starting with open-handed reaches and object extensions followed by points (Bates, 1976; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). Researchers have defined pointing as when the index finger is extended in the direction of an object, open-handed reaching as the extension of an arm with an open hand, and object extending as movements of the arm toward the mother with an object in hand (Bates et al., 1979; Crais, Douglas & Campbell, 2004; Olson & Masur, 2011). These gestures are linked to language acquisition in the early stages of learning (Brooks & Meltzoff, 2008; Carpenter, Nagell, & Tomasello, 1998; Goldin-Meadow, 2002; Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007; Masur, 1982; Olson & Masur, 2011). One reason why infant gestures might be linked to vocabulary acquisition is that infant gestures elicit responses from mothers dependent upon gesture type and context which might help them learn words (Goldin-Meadow et al., 2007; Olson & Masur, 2011).

There are three types of communicative contexts where gestures have been experimentally elicited; proto-declarative, proto-imperative, and ambiguous. (Bates et al., 1979; Carpenter, Mastergeorge, & Coggins, 1983; Harding & Golinkoff, 1979). Proto-declarative contexts are referred to as "commenting gestures" whereas "requesting gestures" are seen more in proto-imperative contexts (Olson & Masur, 2011). Considering the communicative context is important because proto-declarative gestures, such as pointing, are more strongly linked to vocabulary acquisition than proto-imperative gestures (Carpenter et al., 1998). It is also important to consider communicative context because infants produce different kinds of gestures dependent upon context. For example, Olson and Masur (2011) found that 13 month old infants

pointed during proto-declarative contexts and object extended during proto-imperative contexts. During ambiguous contexts, where it is uncertain if the infant is going to comment or request, infants produced an equal amount of points and open-handed reaches (Olson & Masur, 2011).

It is theorized that infants use these gestures to convey different types of messages to their mothers hoping that mothers will understand and/or respond (Goldin-Meadow et al., 2007). Goldin- Meadow and other researchers (2007) found in a recent study of thirteen month olds that their mothers responded to their child's object referencing gestures with object labels. Olson and Masur (2011) extended this study and found that depending on the infant's gesture type, mothers provided the child with an object label, action label, internal state label, or a nonlabel. Mothers responded mostly with object labels to pointing gestures of the infants. The mothers provided the infant with more action labels after object extensions. Internal state labels were provided to the infant across all gesture types and nonlabels were more prevalent after open-handed reaches and object extensions. The authors argued that these kinds of differential maternal responses to infants' gestures could be a mechanism for vocabulary acquisition because mothers provide object labels at 13 months which is when the child is learning object names (Goldin-Meadow et al, 2007; Olson & Masur, 2011). However, it is not known how mothers respond to infants' gestures at 17 months when their vocabularies are expanding to include a greater variety of word types. The current study will explore how infants gesture in three different communicative contexts and how their mothers respond to them at 17 months.

Method

Participants

This study utilized existing data collected from twenty-nine infants, 13 boys and 16 girls, and their mothers when infants were 17 months. Data was originally collected by Olson & Masur (2011) as a part of a larger study. Twenty-seven of the mother-infant dyads were Angelo-American, 1 was African American, and 1 was Asian American. Mothers had an average age of 32. Mothers' ages ranged from 19 to 46 years. Twenty-eight of the 29 mothers reported that they were currently living with the child's biological father. All of the mothers reported to have a high school diploma and 21 had college degrees. Twenty-four of the mothers were working outside of the home. Seventeen of the children were only children. All of the children were judged to be developing as expected and did not have any family history of language disorders, differences, or delays. All dyads were native English speakers. All of the infants had mean expressive vocabularies of 50 words (6-215) according to the *McArthur-Bates Communicative Development Inventory: Words and Gesture (MCDI)* or according to a parent interview (Fenson, Marchman, Thal, Reznick, & Bates, 2007).

Procedure and Stimuli

Procedure

As part of a previous study, mothers played with their infants within a laboratory setting. Each dyad was observed and videotaped for 18 minutes by experimenters who were in the adjacent room. Six stimuli (i.e., communicative temptations) were presented at predetermined time periods to create three different communicative contexts known as proto-declarative, proto-imperative, and ambiguous contexts. These contexts allowed infants to initiate communication

with different types of gestures. During the play sessions, mothers were instructed to play with their child, as they would at home, with the toys available in the room. When a communicative temptation was presented, mothers were told to ignore the communicative temptation until the child responded. Once the child responded, the mothers could respond to the child freely (Olson & Masur, 2011).

Stimuli

A remote control car and a bear were used to create the proto-declarative context (Blake, O'Rourke, & Borzellino, 1994; Carpenter et al., 1983; Carpenter et al., 1998; Franco & Butterworth, 1996; Liszkowski, Carpenter, Henning, Striano & Tomasello, 2004). When the session reached the 6 minute mark, the remote control car was presented and moved 3 times during a 30 second episode (i.e., on 3 seconds and off 10 seconds). As the 8 minute mark approached, the bear stimulus was presented by lighting up in a darkened cabinet while soft music played. The bear was also presented 3 times during a 30 second interval (i.e., on 3 seconds and off 10 seconds). Both items were placed on shelving units that were out of reach to the infant in order to create a reason for the infants to use proto-declarative or "commenting" gestures.

The two ambiguous stimuli were presented following the proto-declarative stimuli at 10 and 12 minutes. The ambiguous stimuli were considered "ambiguous" because stimuli could result in either proto-declarative or proto-imperative gestures from the infant (Franco & Butterworth, 1996). A ball and bubbles were placed on two separate shelving units somewhat out of reach for the infant. Either the ball or bubbles were presented in a randomized order with lights and music at the 10 and 12 minute marks. They were each presented 3 times during a 30 second interval (i.e., on 3 seconds and off 10 seconds).

The two proto-imperative stimuli consisted of a wind-up toy and a light-up duck in a plastic container. These were chosen to elicit proto-imperative responses because the items were difficult for the infant to manipulate on their own, subsequently, they would request assistance from their mothers (Blake et al., 1994; Carpenter et al., 1983; Carpenter et al., 1998; Harding & Golinkoff, 1979; Wetherby, Cain, Yonclas, & Walker, 1988; Yoder, McCathren, Warren & Watson, 2001). The stimuli were presented at the very end of the session when all other toys were removed from the room. The mother presented the child the wind-up toy 3 times at the end of the session. The wind-up toy was then removed while the container with the light-up duck in the plastic container was presented three times.

Coding

As a part of a previous study, infant gestures toward the 6 experimental stimuli were coded as pointing, reaching, or object extending. Vocalizations, looks to the stimuli, and gaze to mother were also coded. Mothers' responses to each infant gesture type were coded as verbal or nonverbal responses. Mothers' verbal responses were further coded as including object labels, action labels, internal state labels, or non labels (Olson & Masur, 2011). Mothers' nonverbal responses were further coded as looks to the stimuli, gazes to their infants, vocalizations, and gestures.

Reliability was obtained for the categorical variables using 2 boys and 2 girls. Cohen's Kappa for categorizing gesture type = .93. Cohen's Kappa for categorizing mothers' labeling responses = .95.

Tallying

The current study tallied this existing coded but unanalyzed data so that infants' behaviors and mothers' responses could be analyzed. See attached tally sheets (Appendix A & B). Within each experimental context, infants' gestural communicative bids toward the experimental stimuli were tallied. Infant gestures were tallied by type of gesture as pointing, reaching, and object extending. Then mothers' responses to infant gestures were tallied by context and gesture type as verbal or nonverbal responses or no response. If the responses were verbal, they were further coded by type of label included in the response as object labels, action labels, internal state labels, or non labels.

Hypotheses and Analyses

Infants

Proto-declarative

1. It was hypothesized that there would be more pointing in the proto-declarative context as compared to object extensions and open-hand reaches.

Ambiguous

2. It was hypothesized that there would be equal amounts of points and open-hand reaches in the ambiguous context with a low number of object extensions.

Proto-imperative

3. It was hypothesized that there would be more object extensions in the proto-imperative context than points and open-hand reaches.

To test the first three hypotheses, a 3 (communicative context: proto-declarative, ambiguous, proto-imperative) x 3 (gesture type: point, reach, object extension) repeated measures analyses of variance was completed to determine if points, reaches, and object extensions occur at different frequencies in each communicative context. The frequencies of gestures produced in each context were used as the dependent variable.

Mothers

Object Labels

4. It was hypothesized that object labels would be most prevalent when the child points as compared to any other gesture type.

Action labels

5. It was hypothesized that action labels would be produced the most after infant object extensions as compared to infant points and reaches.

Internal state labels

6. It was hypothesized that internal state labels would be seen the most often after infant object extensions as opposed to the points and reaches.

Non labels

7. It was hypothesized that nonlabels would be produced the most after open-handed reaches than after points and object extensions.

To test hypothesis 4, 5, 6 and 7, a 4 (labeling response: object, action, internal state, nonlabel) X 3 (gesture type: point, reach, object extension) repeated measures analysis of variance was completed to determine if labels occur at different rates after infants' points,

reaches and object extensions. The proportion of label types produced after each gesture type was used as the dependent variable. Proportions were used so that mothers would not be placed at a disadvantage if their infant did not gesture.

Results

The findings are presented in two sections. The first section describes infants' provision of pointing, reaching, and object extending in the proto-declarative, ambiguous, and proto-imperative context. The following section provides analyses of mothers' productions of object labels, action labels, internal state labels, and nonlabels based on the type of gesture the infant provided.

Infants' Gestures

Infants gestured across all communicative contexts, although, individual infants did not gesture in each context. Twenty-three infants gestured in the proto-declarative context, 26 infants gestured in the ambiguous context, and 23 infants gestured in the proto-imperative context. There were 140 overall gestures in the proto-declarative context (124 points, 0 object extensions, and 16 reaches), 182 gestures produced in the ambiguous context (138 points, 1 object extension, 43 reaches), and 81 gestures in the proto-imperative context (4 points, 69 object extensions, 8 reaches). See Table 1.

In order to test hypotheses 1 through 3, a 3 (context: proto-declarative, ambiguous, proto-imperative) x 3 (gesture: point, reach, object extension) repeated measures ANOVA was completed. The ANOVA revealed a significant interaction of context and gesture type, $F(2.9,64.1)=17.4$, $p<.001$, $\eta p2 = .38$. Pairwise comparisons found that in the proto-declarative

context, pointing occurred more often than reaching (p=.007). Object extensions did not occur at all. The ambiguous context showed that pointing occurred more often than reaching (p=.043) and object extensions (p=.001); although reaching occurred more often than object extensions (p=.001). In the proto-imperative context, object extensions occurred more often than points and reaches (ps< .001). Points and reaches did not occur at significantly different rates in the proto-imperative context.

Table 1

Mean frequencies (and standard deviations) of infant gestures within three communicative contexts.

Context	Point	Object Extension	Open-hand Reach
Proto-declarative	4.28 (5.5)	0.00 (0.00)	0.55 (1.4)
Ambiguous	4.76 (5.96)	0.03 (0.19)	1.48 (1.98)
Proto-imperative	0.14 (0.35)	2.38 (2.03)	0.28 (0.8)

Mothers' Responses

All twenty-nine mothers responded verbally to infant gestures in a least one of the three communicative contexts (23 in proto-declarative, 25 in ambiguous, and 23 in proto-imperative). Mothers' responses included object labels, action labels, internal state labels, or nonlabels dependant on the type of infant gesture. The six mothers who did not respond verbally in the proto-declarative context were not given the chance to respond because the infant did not gesture. Three of the mothers in the ambiguous contexts did not respond verbally because their infant did not gesture. One mother in the ambiguous context had no response when their infant gestured.

The six mothers in the proto-imperative context did not respond because their infant did not gesture. Proportions were used during the analysis to account for variable rates of infant gesturing. See Table 2.

To test hypotheses 4 through 7, a 3 (gesture type: point, reach, object extension) x 4 (response labels: object label, action label, internal state label, nonlabel) repeated measures ANOVA was conducted. It revealed a significant interaction of infant gesture and maternal response label, $F(3.8,107.5)=6.9$, $p<.001$, $\eta p2 = .20$. The pairwise comparisons revealed that mothers provided object labels more often after pointing and reaching than object extensions ($p<.001$). Object labels did not occur at significantly different rates after pointing and reaching. Mothers provided action labels more often after object extensions than points ($p=.021$). Mothers' provision of internal state labels did not significantly vary with gesture type. Mothers provided nonlabels more often after object extensions than points ($p= .308$). Nonlabels after object extensions and reaches did not significantly vary nor did they vary after points and reaches.

Table 2

Mean proportions (and standard deviations) of mother labeling responses after three types of infant gestures.

Type of label	Point	Open-hand Reach	Object Extension
Object Label	0.43 (0.31)	0.38 (0.38)	0.09 (0.18)
Action Label	0.05 (0.11)	0.05 (0.22)	0.17 (0.3)
Internal State Label	0.18 (0.18)	0.19 (0.33)	0.18 (0.35)
Nonlabel	0.23 (0.24)	0.36 (0.41)	0.49 (0.36)

Notes. Proportions were calculated with number of maternal verbal responses in each context as the denominator.

Discussion

The primary purpose of this study was to examine infants at 17 months and their mothers to see how mothers' responded to infant gestures (pointing, reaching, object extending) within different communicative contexts which included proto-declarative, ambiguous, and proto-imperative. Infant gestures elicit different responses from mothers dependent upon gesture type and context that might help them learn words (Goldin-Meadow et al., 2007; Olson & Masur, 2011). Since mother responses to infant gestures at 13 months may be linked to vocabulary acquisition, it was important to look at how infants and mothers are interacting at a slightly older ages, 17 months when infants' vocabularies are expanding to include a greater variety of word types (Brooks & Meltzoff, 2008; Goldin-Meadow et al., 2007; Olson & Masur, 2011). As expected, pointing was the most prevalent gesture type in the proto-declarative context when compared to object extensions and reaches. It was also not surprising to find that object extensions were most prevalent in the proto-imperative context since that is what was found in Olson and Masur's study with 13 month old infants. It was predicted that that there would be equal amounts of points and open-hand reaches in the ambiguous context with a low number of object extensions. More points than reaches were seen in the ambiguous context, which may suggest that the "ambiguous context" is more of a proto-declarative context than an ambiguous context. It is predicted that infants at a slightly older age will gesture similarly to infants at 17 months within these three contexts. To test this hypothesis, a longitudinal study needs to be implemented.

Olson & Masur (2011) found that depending on the infant's gesture type, mothers provided the child with an object label, action label, internal state label, or nonlabel. Similar results were found in the current study as mothers provided the infants with predominantly

verbal responses which included all four of the labels mentioned above. Hypotheses 4 and 5 were supported as mothers provided object labels after points and action labels after object extensions. These findings are similar to infant and maternal behaviors reported by Olson & Masur (2011) at 13 months. Mothers again appear to be using the same pattern of responding to linguistically map infants' communicative intents. However, it is not known if the proportion of object and action labels mothers provided at 17 months is larger than the proportion of labels provided at 13 months. More analyses will need to be conducted to see if there are significant differences between mothers' responses to infants' gestures at 13 months and 17 months. This will provide a better understanding of how mother responses might change in frequency as the child ages.

Unexpectedly, mothers provided internal state labels at similar rates across gesture types. It was predicted that mothers might begin to modulate their provision of internal state labels based on gesture type at 17 months because infants' internal state vocabularies and mental state understanding are increasing. It has also been shown that mothers' provision of these labels is positively linked with children's social understanding (Taumoepeau & Ruffman, 2008). It is possible that mothers might provide internal state labels differentially by gesture type when infants are slightly older which was not examined in the current study. Therefore, further research should be completed.

In addition, mothers provided more nonlabels than expected in this study, especially after object extensions. It was thought that the prevalence of nonlabels might decrease as the infants became older because mothers might adjust their responses to include more specific labeling responses as the child's vocabulary is growing. At 13 months, nonlabels were more prevalent after open-handed reaches and object extensions and less likely to occur following points. The

high prevalence of nonlabels at 17 months especially after object extensions could be because of the demands of the proto-imperative social interaction and the need to keep the conversational exchange going with infants whose conversational abilities are improving while their mobility increases.

This study profiles infants' gestures and mothers' labeling responses at 17 months and may support the idea that mothers labeling responses to infant gestures could be a mechanism for vocabulary acquisition because mothers are providing labels at a time when infants would be learning these types of labels. However, a future study will need to be conducted to see if this profile is significantly different from reported profiles at 13 months. It is important to consider a longitudinal study in order to reveal changes in patterns of mother-infant interaction. These changes in pattern could be indicative of mother responses to infant gesture supporting word learning. A future study will also need to be implemented to determine if maternal labels at 17 months are facilitative of infants' vocabulary acquisition.

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Appendix A

Tally sheets: Infant gestures

Proto-declarative Context (Car + Bear)

Infant Identification Number	*Gender*	*Point*	*Object Exchange*	*Open handed Reach*	*Total Bids*

Ambiguous Context (Ball + Bubbles)

Infant Identification Number	*Gender*	*Point*	*Object Exchange*	*Open handed Reach*	*Total Bids*

Proto-imperative Context (Wind-up toy + Container)

Infant Identification Number	*Gender*	*Point*	*Object Exchange*	*Open handed Reach*	*Total Bids*

Appendix B

Tally sheets: Mother responses

PROTODECLARATIVE

Subject	Verbal	Point (P)	Open handed reach (R)	Object exchange(OE)
	object (n)			
	action (v)			
	mental (m) nonlabels (gap+other)			
	NVR (nonverbal)			
	NR (no response)			

AMBIGUOUS

Subject	Verbal	Point (P)	Open handed reach (R)	Object exchange(OE)
	object (n)			
	action (v)			
	mental (m) nonlabels (gap+other)			
	NVR (nonverbal)			
	NR (no response)			

PROTOIMPERATIVE

Subject	Verbal	Point (P)	Open handed reach (R)	Object exchange(OE)
	object (n)			
	action (v)			
	mental (m) nonlabels (gap+other)			
	NVR (nonverbal)			
	NR (no response)			